

Late Cretaceous-Early Tertiary Plate Kinematics of the South Pacific: Results of a Marine Geophysical Survey of the Antarctic Plate

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A marine geophysical survey was conducted on the Antarctic margin during the 92-93 austral summer from the R/V B Nathaniel B. Palmer. Gravity, magnetic, echo-sounder and single channel seismic data were collected to characterize the Late Cretaceous - Early Tertiary crust, between the Sharp Fracture Zone (FZ) and FZ 8.5, which was created during the early stages of spreading between Antarctica and New Zealand. Many data were collected in previously unsurveyed regions, providing an opportunity to examine, for the first time, some details of the first-order plate kinematic framework in this region.

New magnetic anomaly picks and fracture zone crossings were obtained in several key areas. Combined with existing magnetic/FZ data and Geosat GMRT/FZ picks, they yield new finite reconstructions for AH (~59 Ma), A28/29 (~65 Ma), A30/31 (68 Ma) and A33 (~80 Ma). These new reconstructions support the hypothesis [Stock and Molnar, 1987, Nature], that the Antarctic plate was two separate plates in the Early Tertiary. However, as discussed by Cande et al. [1992, EOS], and reiterated by the new data, the time at which the two plates fused into the single Antarctic plate, making the Pacific-Antarctic Ridge, a continuous plate boundary, is around A27 (~63.5 Ma). Prior to A27, spreading between the New Zealand continental blocks and Antarctica, NE of FZ 8.5, appears to have been accommodated by short-lived microplates, while SW of FZ 8.5 the spreading began earlier and was more stable. The Campbell Plateau and Chatham Rise, initially independent blocks, eventually became sutured onto the older Pacific plate; this likely took place in the Late Cretaceous. An area of rough seafloor, along the southern projection of FZ 8.5 likely marks the fossil boundary between the "Pacific-Antarctic" Ridge to the south and the "Pacific-Bellingshausen" Ridge, or series of ridges, to the north. Our data over this proposed fossil plate boundary yield no apparent patterns of symmetric magnetic anomalies nor fracture zones, indicating that the boundary may have been formed by diffuse deformation and unorganized spreading, or alternatively, may have evolved rapidly with a complex geometry.